U.S. Army Research Laboratory

ALLIANTTECHSYSTEMS

GENCORP AEROJET

GENERAL DYNAMICS
Ordnance and Tactical Systems

Anti-Armor Successes

Scientists and engineers at the U.S. Army Research Laboratory have provided significant contributions to the advancement of anti-armor lethality. Dating back to the World War II era, ARL's predecessors at the Ballistic Research Laboratory established a legacy of contributing significantly to developments in firepower, such as the shaped-charge warheads, fragmenting high-explosive ammunition, large-caliber projectile designs, and high-energy low-vulnerability solid propellant. Recent developments have been instrumental in significantly increasing the effectiveness of U.S. tank and medium-caliber armaments. We have contributed to the development of every sub-caliber kinetic-energy round fielded for the family of Abrams main battle tanks, including the M829A1 and M829A2—the most effective fielded direct-fire munitions in the world today.

105-mm TANK AMMUNITION

M774 Kinetic-Energy Round
- *first monolithic depleted-uranium round*
- *subprojectile design*

M833 Kinetic-Energy Round
- *prototype double-ramp sabot design*

M900 Kinetic-Energy Round
- *sabot lift-off redesign*
- *high-energy, low-vulnerability 19-perf propellant*
- *accuracy assessment*

M900

M919

Impact of long-rod penetrator on threat combat vehicle

Perforation of long-rod penetrator through main armor of threat combat vehicle

M829A2

25-mm AMMUNITION

M791 Kinetic-Energy Round
- *ballistic testing*
- *subprojectile design*
- *defeat range and behind-armor debris investigation*

M919 Kinetic-Energy Round
- *ballistic testing*
- *double-ramp aluminum sabot design*
- *subprojectile design*
- *subprojectile fin design*
- *defeat range and behind-armor debris investigation*

CFD of M829A2 Initial Sabot Lift-Off

120-mm TANK AMMUNITION

M829 Kinetic-Energy Round
- *SB60-24 subprojectile design*
- *first fielded double-ramp sabot design*
- *subprojectile fin design*

M829A1 Kinetic-Energy Round
- *Model-10 subprojectile design*
- *novel propellant grain design*
- *combustion testing*
- *full-scale ballistic testing*
- *accuracy assessment*
- *solution to spin-resonance problem*

M829A2 Kinetic-Energy Round
- *lightweight composite sabot (double-ramp design)*
- *steel fin roll control analysis*
- *first application of partially cut stick propellant*

M830A1 Multipurpose Anti-Tank Round
- *shaped-charge warhead design*
- *sabot design*

OTHER SUCCESSES

140-mm Future Main Tank Armament "shoot-off"
- *two-piece cartridge ignition design*
- *sabot design*
- *subprojectile design*
- *fin design*
- *heat-transfer analysis*

M865E2 (120-mm) training round design

Computational Fluid Dynamics (CFD) of pitch damping for long-rod penetrators

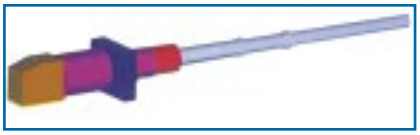
Ballistic testing and screening of candidate propellant chemistries

M830A1

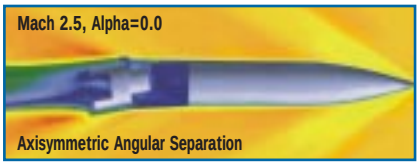
Anti-Armor Research for future armament systems

MODELING

Modeling of Novel Penetrator Designs



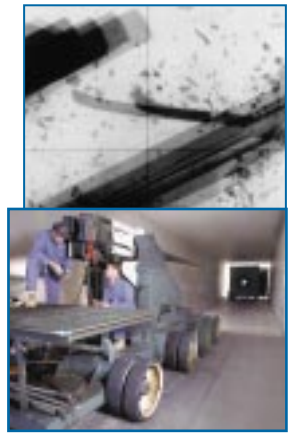
Computational Structural Dynamics of Direct-Fire Gun Systems



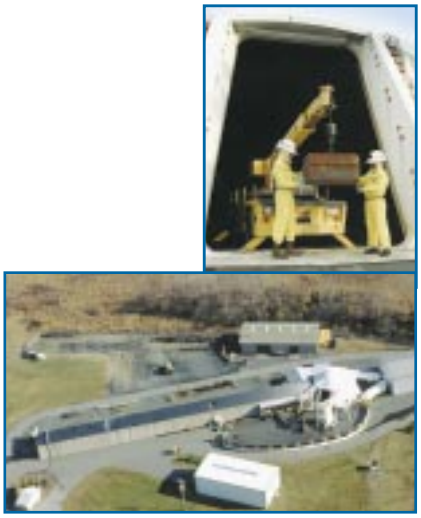
CFD of Axisymmetrically Separating Segmented Rod

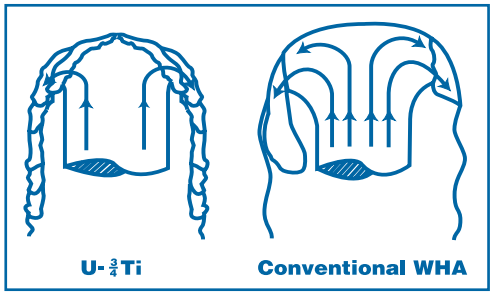
ARL is the Army leader in the investigation of the launch, flight, and terminal ballistics of direct-fire armament systems and in the application of that knowledge to the defeat of all classes of armors. ARL maintains an extensive theoretical, computational, and experimental capability and features an expert staff of scientists and engineers engaged in ballistics and terminal effects research. Together, these resources and capabilities enable ARL to remain at the forefront of anti-armor research. ARL's anti-armor research program is directed toward increasing the lethality of kinetic-energy penetrators, shaped-charge warheads, and explosively formed penetrators delivered by conventional air/surface weaponry. Emphasis is placed on exploitation of novel penetrator and warhead concepts —such as jacketed rods, segmented rods, and long-standoff warheads — and the application of advanced materials and launch mechanisms to these concepts to maximize their lethality.

EXPERIMENTATION

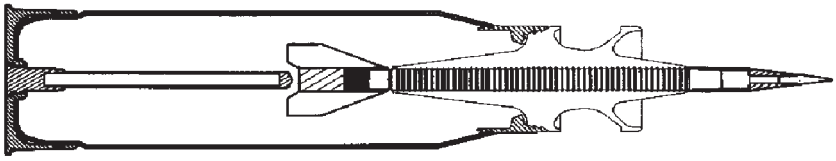


Large-Caliber Armor/Anti-Armor Experimental Research Facility Featuring Environmentally Compliant Depleted-Uranium and Heavy-Metal Containment Capabilities





Penetrator and Warhead Materials



Large-Caliber Kinetic-Energy Ammunition Design

FOR FURTHER INFORMATION

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